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DRO AND PREFERRED SENSORY OBJECTS: A COMPARISON OF TREATMENT EFFECTS IN GROUP STRUCTURED AND GROUP NONSTRUCTURED ACTIVITIES

By

DIANE L. HINVES

(C)

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

SPRING, 1986

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled DRO and Preferred Sensory Objects: A Comparison of Treatment Effects in Group Structured and Group Nonstructured Activities submitted by Diane L. Hinves in partial fulfilment of the requirements for the degree of Master of Education.

Richard Sobey
(Supervisor)

Date: April 11, 1986

ABSTRACT

This study had two main purposes: (1) to determine in which type of activity, group structured or group nonstructured would a DRO procedure be most effective in reducing the rate of self-stimulatory behavior; (2) to determine if the presentation of preferred sensory objects within the group structured sessions would be more effective than DRO in reducing the rate of self-stimulatory behavior. The group structured activity was one in which each student was taught individually in a sequential fashion while other students were present and waiting in the group. A staffing ratio of two staff members to three students existed in the group structured activity. A group nonstructured group activity was one which involved a ratio of one staff member to three subjects where the subjects were given a period of free time to interact with preferred toys.

Four students aged 9 to 11 years served as subjects for this study. Each displayed a minimum of one self-stimulatory behavior which occurred frequently throughout each school day and was determined by staff members to interfere with educational performance. A self-contained classroom, which provided programming for children with severe and multiple handicaps, served as the experimental setting.

The subjects were observed together during thirty minute sessions for each of the group structured and group nonstructured activities. Data was collected on the behavior of each subject by a frequency count.

A single -N- multiple -I design was used to evaluate the effects of (1) a DRO procedure and (2) the presentation of preferred sensory objects on the rate of self-stimulatory behavior. The effects of the two treatments were evaluated independently within the type of the activity, group structure and group nonstructure. The sequence of conditions was altered across subjects.

Results indicated the DRO procedure was associated with an increase in self-stimulatory behavior in three of the four subjects in the group structured and group nonstructured activities. The experiment did not demonstrate a difference in the rate of self-stimulatory behavior within a group structured or group nonstructured activity when a DRO procedure was in effect. Lower rates of self-stimulatory behavior were found under the preferred sensory objects condition than under the DRO condition with three of the four subjects. Potential reasons for the results were discussed and implications for future research and programming with respect to decreasing inappropriate responding were presented.

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CHAPTER I

INTRODUCTION

The differential reinforcement of other behavior (DRO) is a schedule in which a reinforcer is delivered if a particular response has not been emitted for a specified interval of time (Reynolds, 1961). Many texts on behavior modification identify a DRO procedure as an effective least restrictive alternative for decreasing inappropriate behavior (Gaylord, 1980; Gelfand & Hartman, 1984; Popovich, 1981).

Poling & Ryan (1982) in a review of the literature on DRO procedures, analyzed a total of nineteen published studies. In a report of their findings, the following characteristics were common among these studies:

i) the vast majority of studies employed children with a mental handicap,

ii) the majority of studies consequated some form of self injurious, aggressive or disruptive behavior,

iii) a DRO procedure was reported to be used as the sole intervention in only a small number of studies, and

iv) more frequently the DRO procedure was compared to or used in combination with other procedures.

Therapeutic applications of DRO procedures have been examined in a variety of settings, including classrooms, institutional settings and the child's home. Those authors conducting studies in the classroom, report success of the DRO procedure in decreasing maladaptive responding in both individual training sessions and with one or more

students when the whole class is instructed as a group (Repp, Barton & Brulle, 1983; Repp & Deitz, 1974; Repp, Dietz & Dietz, 1976). Despite their success, many authors have neglected to report the type of instructional activity and the reinforcement procedures specific to task performance in effect at the onset and during the study.

A Statement of the Problems: One

An important variable which requires further investigation is the effect of the programming environment on the success of the DRO procedure. Past investigations have not systematically compared the type of activity, structured or nonstructured, when utilizing a DRO procedure, when the quantity of instruction and/or attention given to a student is systematically varied. For example, in an individual or group structured activity, students typically receive a high rate of teacher attention and reinforcement contingent upon task performance. However, this may not occur during nonstructured activities where the student to teacher ratio (eg. 4 students to 1 teacher) may be higher and systematic intervention is not always possible.

Barton, Meston and Brulle (1984) in a brief note, employed a DRO procedure in a nonstructured group activity, in an attempt to reduce multiple maladaptive behaviors of severely multihandicapped students. Eighteen subjects were grouped into two classrooms, all were enrolled in a summer program. The experiment occurred when the majority of staff were eating lunch, thus a ratio of 1:10 existed in one classroom, and 1:8 in the second classroom. Each session, forty-five minutes in duration, consisted of a free play time, without direct instruction, but toys and other items were available to each subject.

The results indicated the DRO procedure was effective in reducing the rate of maladaptive responding of multihandicapped students in a nonstructured group setting. The authors support the viewpoint that a DRO procedure is effective in situations where the numbers of staff are small, and the potential for high rate maladaptive behavior is large.

Luiselli, Helfen, Colozzi, Donnellon and Pemberton (1978), employed a DRO procedure in three individual instructional activities: (1) language, (2) pre-writing and (3) shoe tying. The experiment attempted to reduce the self-inflicted biting behavior of a person diagnosed as moderately mentally handicapped. In addition to the DRO procedure, reinforcement contingent upon correct task performance was delivered. This reinforcement procedure consisted of the delivery of social praise after each correct response (FR1) and the delivery of a token after each third correct response (FR3). Tokens were then exchanged for participation in scheduled activities during the day; eg. snack, play. Each training session, approximately twenty-five minutes, consisted of the teacher working with the subject and one other student, for alternating three minute periods during the session.

The results of the study indicated the DRO procedure to be effective in reducing the rate of hand biting in each type of instructional activity. However, the author postulates that given the delivery of a more potent reinforcer contingent upon correct performance and no DRO procedure, it was possible that the targetted response would have decreased.

As indicated by this brief review, the structure of the activity and related schedule of reinforcement are variables that potentially affect the success of a DRO procedure, but a gap in the research exists because their role has not been systematically investigated. This writer postulates that the reinforcement procedures contingent upon task performance could possibly influence the therapeutic effectiveness of the DRO procedure. One of the purposes of this study and the initial experimental question then becomes:

> In which type of activity, group structured or group nonstructured, will a DRO procedure (differential reinforcement of other behavior) result in the greatest reduction of self-stimulatory behavior exhibited by students with severe and multiple handicaps?

Brown, Holvoet, Guess and Mulligan (1980) refer to group instruction as a structured, data-based training activity in which two to four students are taught together. In a summary of the research on group instruction with handicapped students, Reid and Favell (1984), outline three models of instruction. One is the sequential model where each student is taught individually in a sequential fashion while other students are present and waiting in the group. The second model is the combination/sequential approach involving some instructional components that are implemented with students concurrently, followed by a period of individual instruction. The final approach described is the tandem individual-to-student paradigm where the teaching situation is systematically extended to include more students.

This study includes a sequential model of group instruction and a group nonstructured activity involving free play with access to preferred toys and items. Reid and Favell (1984) suggest a need

for future investigation of effective methods of managing undesirable behavior that occurs during group instructional activities. Past research has focussed on the deceleration of inappropriate responding during individual instructional sessions, or group sessions not involving systematic instruction.

A Statement of the Problems: Two

Characteristics of stereotyped behavior are defined as high response rates, mechanical repetitiveness and lack of apparent social function (Repp, Deitz & Speir, 1974). Lovass states (cited in Koegel & Covert, 1972) that because stereotypic behaviors do not produce social consequences for the child, they have been referred to as "self-stimulatory behaviors". Typical examples of such behaviors that appear in the literature are rhythmic rocking, hand or arm flapping and mouthing of hands or objects. Koegel and Covert (1972) studied the relationship of self-stimulation to discrimination learning with autistic children. The results of the study indicated: 1) the subjects did not acquire the discrimination while they engaged in self-stimulation, 2) suppression of self-stimulation produced an increase in correct responding, and 3) successful discrimination learning was always associated with a reduction in self-stimulatory behaviors. The authors conclude that if one attempts to teach a new behavior to a child, it is important to ensure that the child does not engage in self-stimulatory behavior. Because of this response interference and the nonfunctional nature of self-stimulatory behavior, researchers have sought to decrease this class of responding in laboratory and applied settings.

Evans and Meyer (1985) hypothesized that self-stimulatory behavior might in fact be related to its sensory feedback properties. Secondly, at the onset of the behavior there were few alternative behaviors available to the child. As an intervention the authors suggest replacing the self-stimulatory behavior with an alternate adaptive skill. An example provided in their text was the introduction and acquisition of play skills to replace the stereotyped mannerisms.

Previous research has demonstrated that by enriching the environment with toys, a decrease in self-stimulatory behavior occurs. Davenport and Berkson (1963) found a decreased rate of self-stimulation when handicapped children were provided with objects to manipulate. Berkson and Mason (1964) produced further decreases in self-stimulatory behavior with the additional social stimulation of having an adult present the toys. An additional investigation completed by Mosley, Faust and Reardon (1970) indicated that object manipulation and social stimulation reduced the rate of stereotypic behavior.

A second purpose of this study and the final experimental question then becomes:

> Will the presentation of preferred sensory objects between stimulus presentations within the group structured sessions be more effective than a DRO procedure in reducing the rate of self-stimulatory behaviors?

Glossary

Arousal induction hypothesis: Assumption that as an organism is provided with additional stimulation, rates of self-stimulatory behaviors will decrease.

Autistic like behavior: Behavior characterized by a severe disturbance of affect, uneven developmental rates and sequences and disturbances in perception, speech and language.

Communicative intent: The use of conventional or unconventional methods of communication to influence the behavior of siginificant others. (e.g. reaching to a desired object, eye contact with adult).

DRI: differential reinforcement of incompatible behavior: A schedule in which a reinforcer is delivered if an incompatible response (a response that cannot be performed at the same time as the undesired target response) is emitted.

DRO: differential reinforcement of other behavior: A schedule in which a reinforcer is delivered if a particular response has not been emitted for a specified interval of time.

Frequency count: Counting the number of times a behavior occurs in a given period of time.

Group Structured activity: Sequential model: Data based training in which two to four students are taught together. Each student is taught individually in a sequential fashion while other students are present and waiting in the group.

Group nonstructured activity: Two to four students are seated in close proximity of each other and given free access to preferred objects. The delivery of systematic instruction does not occur.

Least restrictive alternative: Programming specific to the educational/behavioral needs of the child that is presented in the least intrusive manner, provides opportunities for optimal learning and independence.

Momentary interval DRO: The delivery of reinforcement if the individual is not engaging in the targetted (undesired) behavior at the precise moment that the DRO interval ended.

Overcorrection: A reductive procedure comprised of either (or both) of two components: 1) Restitution, which requires the individual to restore the environment to a state improved from which existed prior to the disruption. 2) Positive practise, which involves repeated practise of a positive incompatible behavior.

Preferred sensory objects: Those items which produce (visual, auditory, tactile, gustatory, or olfactory) stimulation which would be likely to regulate, and engage the subject.

Rate per minute: The average frequency of behavior emitted during a unit of 1 minute. Formula:

$$\frac{\text{number of responses in observation period}}{\text{number of minutes in observation period}}$$

Self-stimulatory behavior: Behavior characterized by a high response rate, mechanical repetiveness and lack of apparent social function (e.g. rocking, hand flapping, mouthing).

Stimulus presentation: The presentation of a discrimniative stimulus to influence the probability of the occurence of a response.

Time out: A procedure in which the opportunity to receive reinforcement is contingently removed for a specified period of time. Either

the individual is removed from the reinforcing environment or the reinforcing stimuli in the environment are removed from the individual.

Whole interval (DRO): Delivery of reinforcement at the end of the specified interval if the student did not emit a targetted response at any time during the interval.

Within subject design: (Single-case designs, intra-replication designs). An experimental design which demonstrates control by the independent variable through the comparison of behavior of the same subject under different conditions and the continuous measure of one or more experimental conditions over time.

CHAPTER II

A REVIEW OF THE LITERATURE

The Etiology of The DRO Procedure

The literature relevant to the etiology of the DRO procedure can be traced as far back as 1961, where George S. Reynolds studied it's effect on four male pigeons. Reynolds studied the variables responsible for behavioral contrast using multiple schedules of reinforcement. Reynolds defined behavioral contrast as changes in the rate of responding controlled by one stimulus that are directly caused by the increase in responding controlled by a second stimulus. Thus, the purpose of Reynold's study was to modify the rate of pigeon pecking during the presentation of one stimulus by changing only the schedule of reinforcement associated with a different stimulus.

Each of the four procedures introduced had a daily experimental session consisting of 30 cycles of a two-component multiple schedule. The first component was a 3-minute illumination of a red or orange key, the second component was a 3-minute illumination of a green or blue key. The multiple schedule of reinforcement consisted of the first component always remaining as a variable interval of 3-minutes and the second component varied the use of the following procedures:

1) variable interval, 3 minutes
2) DRO procedure (50 or 75 seconds)
3) Time out (no lights illuminated, no reinforcement, concurrently implemented with a DRO)
4) Extinction (withholding reinforcement whether or not the behavior occurred).

For the purpose of this review, only the DRO procedure and those procedures combined with it will only be discussed.

The DRO procedure was defined as a schedule of reinforcement for not responding. The delivery of reinforcement to the pigeon occurred if it had not pecked the key, for a specified interval of time. Reynolds uses the term "not pecking", synonymously with "not responding", and "other behavior". Each pecking response began a new interval of not responding, the interval length was set at fifty or seventy-five seconds.

Results of the experiment indicated that pecking behavior was reduced to low levels by reinforcing no response (DRO), when the stimulus to respond was not available (time out), and by withholding reinforcement any time the pecking behavior occurred (extinction). In contrast the study indicated low rates of responding would increase using the extinction procedure concurrently with a variable interval of three minutes.

In 1961, Harlan Lane, similarly studied the effects of multiple schedules of reinforcement on the vocal responding of four chicks. One component of Lane's experiment studied the effects on the rate of vocalizing when fixed-interval reinforcement was alternated with differential reinforcement of no responding. For the purpose of this review, this will be the only component discussed. The purpose of this component was to determine if multiple schedules of reinforcement could be used to separate the effect of food as a reinforcer from its effect as an eliciting stimulus in controlling the rate of vocal responding. Fixed interval and the DRO schedule, each associated with a different

colored light, were alternated (FI, 2 min., DRO, 2 min.). Approximately 2 minutes after each stimulus was presented a reinforcement was received.

The results indicated low rates of chirping under stimulus 2 (DRO procedure) and increased rates of responding under stimulus 1 (fixed interval). Lane concluded that the difference in the rate of responding could be attributed to the different contingencies of food reinforcement.

In 1961, Roger T. Kelleher introduced a schedule of reinforcement which he described as a DRP, differential reinforcement of pausing behavior. The purpose of Kelleher's experiment was to determine the effects of a magazine sound (solenoid pulling a hopper into place), during extinction by scheduling the presentation of the magazine sound just as the presentation of food is usually scheduled. Prior to this experiment, the subjects (2 male pigeons) had been trained to peck a key, to obtain the reinforcement of a 4 second access to a hopper of grain.

The DRP procedure involved eliciting the magazine sound, whenever the bird paused for a 10 second period of time. Alternated with the DRP procedure was a fixed interval schedule of five minutes, involving the introduction of the magazine 5 minutes after the first response occurred. An additional schedule alternated with the DRP procedure was a fixed ratio, involving the introduction of a magazine sound whenever the bird emitted a specified number of responses.

The reinforcement of the pausing behavior resulted in a decrease in the response of the pecking behavior. In contrast, the

fixed interval and fixed ratio schedules of reinforcement resulted in high rates of pecking behavior. The magazine sound was effective as a conditioned reinforcer.

Investigations on the effect of a DRO procedure with human behavior can be traced as far back as 1968. Brigham and Sherman (1968) studied the effects of reinforcement of the imitation of English words with three preschool children. During each of the experimental conditions English and Russian words were presented. Experimental phases consisted of reinforcement of accurate English imitations, reinforcement of behavior other than English imitations (DRO) and pairing of English words with reinforcement.

The DRO procedure consisted of reinforcing the subject, 5 seconds after the last imitation of each English word, and before the next stimulus word was presented. Reinforcement was not contingent upon correct performance. The effects of the DRO procedure demonstrated that if reinforcement was discontinued for all imitative responses and delivered contingent upon the occurrence of other responses (eg., no response, incorrect response) not related to the imitative performance, a decrease in all imitative responses occurred.

DRO and Its Effect on Self-Stimulatory Behavior

One of the earliest studies to investigate the effects of a DRO procedure on the rate of self-stimulatory behavior, was conducted by Mulhern and Baumeister (1969). The applied value of this study is limited as it was conducted in a laboratory setting, strapping each of the two subjects into an aluminum chair. The targetted self-stimulatory behaviors were defined as rocking back and forth with extension of arm and complex finger manipulations and rhythmic body rocking with

occasional head rolling. The rate of self-stimulatory behavior was measured using an automated device consisting of a motion detector, comprised of a sound transmitter generating a high frequency sound wave. Disruption of the sound field by any movement caused a pulse to be emitted, a cumulative counter was used to record the responses. Any unit of behavior (physical movement) was defined as an interruption of the sound field. It was suggested by the authors that any movement of either subject was of stereotyped character, thus it was assumed that the measure of any movement would reflect the rate of stereotypy.

The DRO procedure consisted of the delivery of a reinforcer (candy) into a reinforcement tray paired with the flashing of hopper lights if the subject remained still for four seconds. If the subject engaged in any movement during the absence of the hopper lights a 50 decible tone was emitted, green panel lights flashed on and the movement was recorded on the counter (discriminitive stimuli to signal absence of reinforcement). The results of the first experiment indicated an increase in the self-stimulatory behavior to above baseline level with subjects one and two.

In the second experiment, the above procedures were replicated with the addition of more salient discriminitive stimuli (1 - noise, 2 - green lights and bright house lights). The authors hypothesized that the addition of the more salient discriminative stimuli would condition the absence of response to the delivery of reinforcement. The results of experiment two indicated a decrease in self-stimulatory behavior with both subjects. The authors concluded by postulating that stereotypic behavior could be susceptible to modification through the use of operant principles.

This experiment has minimal applied value to educational programs for the handicapped child in classroom settings. The behavioral definition as measured implies any movement as stereotypic in nature. This is an inaccurate measure, which in turn may have had considerable effects on the results of each experiment. Woods (1983) refutes the study of Mulhern and Baumeister (1969) by stating an operant analysis of behavior cannot proceed without a definable response-consequence relationship. The DRO procedure fails to specify target responses (eg. other behavior) therefore the DRO procedure defies the principles of operant learning, antecedent-behavior-consequence.

Similarly using an automated device, Ball, McCrady and Tieixeira (1978) demonstrated success with a DRO procedure to reduce steretotyped behavior in a therapeutic setting. The authors tested the notion that for at least one kind of stereotyped behavior, the continuous subject monitoring demanded by differential reinforcement of other behaviors, could be assumed by an automatic device. The subject was diagnosed as severely handicapped and exhibited a rhythmic rocking behavior. The automatic device consisted of a mercury switch sensor which responded to changes in orientation. A tube which was enclosed in a protective sheath was sewn into a piece of denim clothing. Whenever the subject rocked forward the mercury switch activated causing the timer to reset to zero. When the subject maintained an upright posture (non-rocking) the timer cycled and the buzzer activated at a present interval. The subjects rocking could be depressed by standing next to him, thus the training strategy involved a combination of fading the physical proximity of the experimenter and reinforcing

increasingly longer periods of non-rocking (DRO). The DRO intervals increased from thirty seconds to 6.5 minutes, but a formal criterion for lengthening intervals was not evident.

Displayed in a reversal design, the results indicated a reduction of the rocking behavior from 71.6% during the first phase to 0.0% by session 17, treatment I. The second baseline indicated an increase to the level of 97.5% for the rocking behavior in treatment II. Treatment was reinstituted resulting in a decrease to 0.0% by session 36.

Foxx and Azrin (1973) reported unsuccessful results with a DRO procedure in an attempt to reduce self-stimulatory behavior exhibited by two subjects with severe mental handicaps. The purpose of the study was to compare the relative effectiveness of an over-correction procedure with four alternative procedures: (1) free-reinforcement, (2) reinforcement for non-mouthing, (3) punishment by a slap and (4) a distasteful solution. The self-stimulatory behaviors were defined as continuous mouthing of objects by subject one and continuous hand mouthing by subject two. The DRO procedure was defined as the delivery of edibles and praise each time the absence of the target behavior occurred for 10 seconds. A period of ten seconds was selected as the duration because that interval of non-mouthing occurred frequently during baseline.

The results indicated the free reinforcement procedure and the DRO procedure to be the least effective treatments resulting in minimal decreases in the target behaviors. The overcorrection procedure resulted in rapid elimination of the target behavior.

In 1974, Repp, Deitz and Speir tested the efficacy of the DRO procedure when used alone to reduce stereotypic responding with three students diagnosed as severely handicapped. Repp, et al. (1974) commented that although punishment procedures are reported to be effective, punishment must often be intensive to be effective and is often restricted in many facilities. In this study the effects of a DRO procedure were studied independent of various methods with which it has been combined. The self-stimulatory behaviors were defined as lip flapping, rocking, and repetitive hand motions. The study was conducted in four phases, for each subject the procedures were identical. Phase one consisted of baseline conditions, teacher saying "No" each time the targetted response occurred. Phase two was the DRO procedure, in addition to the teacher saying "No" each time the targetted response occurred. The DRO interval was equal to the inverse of the mean response rate during baseline. If the subject did not emit the defined stereotypic response during the set interval a bell rang and the teacher hugged and verbally praised the student for 2-3 seconds. If the subject did emit the response the teacher reset the timer. After responding decreased, the DRO interval was increased by either 10 to 20 seconds if the previous sessions indicated consistently low response rates, 20% less than baseline means. Phase three was a return to baseline conditions and in Phase four the DRO procedure was reinstated.

With each subject the DRO procedure was successful in reducing the targetted behaviors. The authors concluded that a DRO procedure was effective and appropriate in reducing stereotypic behavior.

Tierney, McGuine and Walton (1979) studied the feasibility of a DRO and effectiveness of variable time (VT) schedules of reinforcement as a means of reducing the body rocking stereotype with two subjects diagnosed as profoundly mentally handicapped. The DRO interval was set at twenty seconds, and a small sweet was given to the subject at the end of each interval in which rocking did not occur. When a reinforcer was given to subject one, one was also given to subject two, irrespective of the behavior (variable time schedule).

The rates of body rocking were not altered significantly for either subject, in either condition (DRO; VT schedule). The DRO schedule contingencies rarely resulted in a reinforcer delivery during the first half session and frequent reinforcement during the second half of the session. The authors hypothesized fatigue caused this to occur. The authors postulated two reasons as to why the DRO procedure was ineffective. First, the trainers experienced difficulty in concentrating to the required degree over one entire session (140 minutes). Second, because the trainers experienced difficulty, there is a probability that the reinforcers were delivered inappropriately thus losing control over the "pausing" behavior.

Harris and Wolchik (1979) similarily reported unsuccessful results with a DRO procedure when compared to two other procedures - time out and over-correction. The subjects were four boys diagnosed as autistic, exhibiting self-stimulatory behavior. The behaviors were defined as repetitive movements of the hands (2 or more times) and repetitive turning of objects. Each three-second interval without self-stimulation marked the onset of a new interval.

In experiments one and two the DRO procedure consisted of each subject receiving social reinforcement after every second academic trial if not engaged in self-stimulation. For example, the trainer reinforced the academic response if correct, and then recorded the response. As the trainer turned back to the subject, the reinforcement was delivered if he was not engaging in self-stimulation. In experiment one praise was delivered, however in experiments two and three food was substituted. In experiment three, activities involved play rather than work and thus were not marked by discrete trials. The DRO interval was twenty seconds so that at the end of every interval the trainer would reinforce appropriate play, if it was occurring, or prompt it, if it was not. Five seconds later, if the subject was not engaged in self-stimulation, he was praised and given food reinforcement with some specification of the appropriate behavior.

The results of experiment one indicated subject one's behavior increased while the behavior of subject two remained at baseline level. Over-correction was identified as the most effective procedure. In experiment two, subject three's behavior remained at baseline level and in experiment three, subject four's behavior displayed a minimal decrease. Over-correction in all three experiments led to an immediate decline in the self-stimulatory behavior's exhibited by all four subjects.

Repp, Barton and Brulle (1983) conducted a study in attempt to systematically replicate the ineffective results of the DRO procedure, demonstrated by Harris and Wolchik (1979). In the first experiment Repp, et al. (1983) replicated the ineffectiveness of the DRO procedure

using a momentary schedule of delivery. A momentary schedule is defined as the delivery of reinforcement if responding is not occurring at a particular moment of observation. However, when a whole interval DRO (reinforcer delivered if the behavior was not emitted for the entire interval) was instituted in the same experiment, the results indicated a decrease in the targetted behavior of subject three. This result was replicated in experiment two. Based on the results, the authors suggest that if we are to use a DRO schedule of reinforcement, we should implement the whole interval method of programming it.

DRO: Calculating Interval Size

Whether the results of past studies were successful or unsuccessful, many authors, researching the effects of DRO procedures have neglected to report specifically how the initial interval of the DRO was calculated. The initial interval length may be a significant variable in determining the success or failure of a DRO program (Repp & Slack, 1977). The initial interval length should be sufficiently short for behavior to contact the reinforcing contingency regularly (Frankel, Mass, Shofield & Simmons, 1976; Poling & Ryan, 1982; Sulzer-Azaroff, 1977). Several studies (Repp, Deitz & Deitz, 1976; Repp & Deitz, 1974; Repp, Deitz & Speir, 1974) have demonstrated that short DRO intervals can rapidly reduce behavior.

Repp, Deitz and Speir (1974) introduced a formula to determine the initial DRO interval length as the inverse of the rate of response. For example, if the average baseline rate was 3 responses per minute, the initial DRO value would be one minute divided by three, equal to

twenty seconds. This formula was developed to ensure the rate of reinforcement for not responding could equal the maximum possible rate of reinforcement for responding.

Repp and Slack (1977) conducted a two phase experiment in a laboratory setting to assess the effects of stimuli associated with different initial DRO values in a program with increasing DRO intervals. The first phase consisted of a multiple DRL schedule (differential reinforcement of low rates of responding). In the second, final phase subjects responded to a schedule of DRO_1, DRO_2, DRO_3 and DRL in which the interval values of the three DRO components were 1, 12 and 20 seconds respectively. As each subject attained the criterion for increasing the initial interval size, values were increased along a series of 1, 2, 6, 12, 20, 30, 42, 56 and 72 seconds.

Results of the two phase experiment indicated the greater the initial DRO value (eg. 20 seconds) the less efficient the stimuli correlated with that component were in meeting the criterion for an increase in the interval. The criterion for increasing an interval was consistently attained when the initial interval was a value less than the inverse of the mean response rate in phase 1 (Multiple DRL schedule). The authors postulate that if these findings are replicated in applied settings, the results will have identified one of the important variables (initial small DRO interval) that could account for differences with experimental success with DRO schedules, when employed to reduce inappropriate responding.

In a brief note, on DRO procedures authored by Barton, Meston and Brulle (1984), modifications of traditional scheduling and interval

calculation were introduced. The purpose of this study was to determine if a DRO could be effective in managing the maladaptive behaviors of groups of severely to profoundly handicapped students. The initial DRO interval was calculated by taking the inverse of the mean response rate during baseline. Each daily subsequent interval was determined by the highest rate of responding exhibited by any of the students during the previous day. Intervals were rounded to the nearest 10 seconds. Although non-experimental in nature the data suggested the DRO procedure to be effective and efficient in producing decreases in individual response rates when the daily interval was set according to the previous day's highest rate of responding.

When behavior is controlled at one DRO interval a longer interval may be instituted. Repp et al. (1974) suggested small stepwise increases in which the interval is incremented by a constant time, only when responding is adequately reduced at the initial length. Repp et al. (1976) in an attempt to reduce the behaviors of hair twirling, hand biting and thumb sucking of 3 handicapped persons, implemented a schedule for the gradual increase of the initial DRO interval. The initial interval was based on the inverse of the mean response rate during baseline. For the first subject the initial DRO interval was set at 30 seconds, but was increased to one minute after the first session in which 2 or fewer responses per minute occurred. Using the same criterion, the interval was increased by one minute increments until a final value of a DRO of 5 minutes was attained. For the second subject the initial interval was one second and was increased by fifteen second increments until a DRO of 1 minute was in effect. The

interval was then increased by thirty second increments, increases were made when the rate of responding was less than 3 responses per minute. The third subject began at an initial interval of one minute, followed by an increase to two minutes; a criterion was not evident. Results of the study indicate the DRO procedure to be most effective in reducing the rate of inappropriate responding when the initial DRO interval is set equal to the mean response of the baseline rate and subsequent intervals are gradually increased.

Barkley and Zupnick (1976) similarily defined a schedule for increasing the interval length, in attempt to reduce stereotypic body contortions of a subject diagnosed as mentally handicapped. The authors implemented a physical restraint procedure in conjunction with a DRO procedure. The initial interval began at one minute and was increased when the subject successfully completed two consecutive intervals. The one minute interval increases continued up to a DRO of 10 minutes, followed then by increases varying between 5 and 10 minutes. The results of the studies conducted by both Repp et al. (1976) and Barkley et al. (1976) demonstrated that by increasing the interval by increments of a constant time period continued suppression of inappropriate responding can be maintained.

Lichstein and Kachmarik (1980) introduced a schedule to increase DRO intervals, and to study the effects of generalization and maintenance of the intervals across three different settings. Two school-aged children of normal intelligence who exhibited a high rate of thumb sucking were chosen for this study. Three DRO procedures were implemented; a thirty minute session in the home with an initial

interval of five minutes. Each successive interval was increased by five minutes, until the entire session (30 minutes) was regarded as one interval. The thirty minute experimental sessions were terminated and the DRO schedule was thinned to include the entire day. The day consisted of three intervals, the time spent at school, the time from the end of school to supper and the time from supper to bed time. The three intervals were condensed to two intervals, including only the time at school and the time at home.

The results indicated the DRO schedule in all three components to be effective in reducing the thumb sucking behavior with both students. However, the authors pointed out that maintenance across time was not evident and after three months, the thumb sucking behavior returned to baseline levels for both subjects.

Another important variable specific to the scheduling of a DRO procedure, as introduced by Repp, Barton and Brulle (1983) is the whole interval versus the momentary interval. A whole interval is defined as the delivery of reinforcement at the end of the interval if the child did not emit a targetted response at any time during the entire interval. A momentary interval was defined as the delivery of reinforcement if the subject did not engage in the targetted behavior at the precise moment the DRO interval ended.

Results of the two experiment study revealed that a whole interval schedule of DRO was more effective in initially decreasing the targetted behaviors. However, a momentary interval is effective in maintaining the reduction at low levels. The DRO intervals were not gradually increased in either experiment; as the authors pointed out,

although customary, such a plan would have confounded this study, not allowing an easy comparison between the two types of schedules.

Summary: The State of the Art

In a small number of studies, DRO reportedly was used alone. Data from these articles indicate the DRO schedules can be effective in suppressing behavior in the absence of other behavioral techniques. If a DRO procedure is to be a viable technique for reducing inappropriate responding, specific parameters with respect to the procedure must be considered.

The most important parameter is establishing the initial interval size. Past literature reveals that the greater the initial interval, the less effective the DRO procedure is in reducing the rate of inappropriate responding. This finding may explain why some researchers (Repp & Deitz, 1974; Repp, Deitz & Deitz, 1976) found DRO schedules to be extremely effective in reducing responding, while other researchers have not.

The ease of treatment in the therapeutic setting increases when the initial interval increases. The maximum applied value can be attained through increasing the initial interval according to a prespecified criterion. It is suggested to increase the interval by a constant period of time when a number of successful intervals (ie. 2) are attained. Repp et al. (1983) propose that an important parameter which implies success, is the delivery of the reinforcer, only if the response is not emitted for the entire interval (whole interval

scheduling). The relevance of this parameter may require a more extensive data base than currently exists.

In conclusion, DRO procedures used alone, or in conjunction with other behavioral techniques have been demonstrated to be a useful response deceleration technique. When carefully conceived and implemented the DRO procedure can be considered as an ethical and least restrictive alternative method of reducing undesired responding.

CHAPTER III

METHODS

Subjects

Four students aged 9 to 11 years who attended an Edmonton Public school served as subjects for this study. The students were enrolled in a self-contained classroom which provided programming specifically for children with severe and multiple handicaps. These children were selected for this study because they demonstrated the following characteristics:

1) Diagnosis of a severe developmental delay as assessed by a medical professional.

2) Each displayed a minimum of one self-stimulatory behavior which occurred frequently throughout each school day and was determined by staff members to interfere with educational performance.

In addition to the severe developmental delay in all subjects, subject C also has a diagnosis of cerebral palsy and a severe convulsive disorder partially controlled by medication. Subject D was assessed as displaying behaviors commonly associated with autism, characterized by a severe disturbance of affect, uneven developmental rates and sequences and disturbances of perception, speech and language. All four subjects were observed as engaging in maladaptive responding consisting of self-stimulatory, aggressive, and disruptive behaviors.

Subjects A, B and D repetitively placed one or both hands in their mouth, at times to the exclusion of appropriate social or object

interaction. Subject C had a tendency to move her hands in a repetitive circular, forward, or backward motion, continually scratching the table surface. Subject information is summarized in Table I. (A video tape of each subject in all experimental conditions is available from Dr. Richard Sobsey, Department of Educational Psychology, University of Alberta. Access to the video tape can be arranged for those individuals conducting related research or attempting to replicate this study.)

Setting

The daily classroom of the four subjects served as the experimental setting. Staff consisted of one certified teacher and two developmental assistants to provide programming for the total of five students enrolled in the program. Daily programming in the classroom focussed on curricular areas such as motor, self-help, cognition, socialization, communication and play skills. Each student received individual instruction in curricular areas of need and participated in a minimum of two group instructional sessions where communication skills were integrated with other curricular activities. Group instructional sessions typically occurred at large round tables where students were seated adjacent to one another.

The classroom organization was such that each staff member was given the opportunity to instruct each student on a rotating basis in both individual and group instructional programs. This approach was utilized in an attempt to facilitate consistency amongst staff with curricular instruction and behavior management, and promote generalization by students across instructors.

TABLE I

SUBJECT	AGE	SEX	DIAGNOSTIC INFORMATION	SELF-STIMULATORY BEHAVIOR
Subject A	9 Years	Male	Severe developmental delay.	Mouthing of hands. - repetitively placing one or both hands in mouth.
Subject B	11 Years	Male	Downs Syndrome. Severe developmental delay.	Mouthing of hands. - repetitively placing one or both hands in mouth.
Subject C	10 Years	Female	Severe developmental delay. Cerebral Palsy. Severe Convulsive Disorder.	Hand movements. - repetitively scratching table surface.
Subject D	8 Years	Male	Severe Developmental Delay. Severe Behavior Disorder (Autism).	Mouthing of hands. - repetitively placing one or both hands in mouth.

Preferred toys and task materials were arranged on shelves in the classroom providing independent access by students. Carpeted areas and leisure centers (eg. music, tactile walls) were designated as spaces for free play and tables located in specific areas accommodated the instructional sessions.

Independent Variables:

The independent variables were defined as:

1. The degree of structure of the activity including, i) a group structured activity and; ii) a group nonstructured activity;
2. The application of a D.R.O. procedure, differential reinforcement of other behavior;
3. The presentation of a preferred sensory object between stimulus presentations within a group structured activity.

1.(i) Group structured activity:

The group structured activity, a sequential model as defined by Reid & Favell (1984), was one in which each student was taught individually in a sequential fashion while other students were present in the group. The structured sessions involved a ratio of two staff members to three subjects, where the quantity of instruction was such that each subject received individualized training on a predefined objective within a curricular domain. The physical setting was arranged such that each student was seated adjacent to one another at a horseshoe shaped table. One staff member was seated on the opposite side of the table directly facing the subjects. The second staff member was positioned directly behind the students.

The role of the first staff member was to provide rapid individual instruction, one trial per subject, in a sequential fashion. This staff member was responsible for recording the individuals response, followed by the delivery of a reinforcer for correct response and a correction procedure for an incorrect response. The reinforcer was defined as social praise paired with a preferred edible or drink item. The correction procedure involved the re-delivery of the task cue, minimal physical assistance paired with mild social praise.

The role of the second staff member was to socially reinforce appropriate behavior displayed by the subjects who at the time were not receiving individual instruction. Appropriate behavior was defined as maintaining the seated position with a physical orientation facing forward or to another subject. The subject's hands could either be resting on the table or on his/her lap.

The group instructional sessions were occurring in the classroom prior to the onset of this study. Their content focussed on: sensory stimulation, food preparation, and communication activities.

Sensory stimulation activities involved the individualized presentation of items in the manner appropriate to the sense being stimulated. For example, an object which elicited auditory feedback was presented paired with the task directive to access the sound (eg. music box "turn"). A second example might include presentation of a sweet smelling food item, paired with the task directive of "smell".

Food preparation activities consisted of making toast, including taking the bread from the sandwich bag, placing it in the toaster, removing from the toaster and consuming. Additional skills introduced at the end of each session involved wiping hands, face and table.

Instruction specific to the development of communication skills required that each subject exhibit requesting behaviors upon presentation of a food or drink item. Staff provided additional instruction to facilitate choice making when students were presented with both a food and drink item.

Sensory stimulation and food preparation activities each occurred at frequency of two, fifteen minute, morning sessions per week. Communication activities occurred each afternoon for the duration of a fifteen minute session.

1.(11) Group nonstructured activity:

A group nonstructured activity was one which involved a ratio of one staff member to three subjects where the subjects were given a period of free time to interact with preferred toys. The physical setting and position of each subject was identical to the structured group activity. The one staff member involved was seated directly facing the subjects on the opposite side of the table. A variety of toys were arranged on the table within each child's reach in order to maximize the accessibility of the various toys. The toys were judged as preferred based on past observations and data collected from sensory stimulation activities by the staff members.

Teachers interacted with students by providing social praise and/or response to a request, contingent upon the students emitting the following behaviors;

1) Appropriate manipulation of an object, defined as the turning of the object paired with eye gaze at the object and/or demonstrating a cause and effect relationship with the object. An

example of the latter was pressing a specific button, producing a buzzer noise.

2) Demonstration of communicative intent to the staff member. The behaviors representing communicative intent were individualized for each subject and were defined as follows:

Subject A:

i) The extension of one or both arms to an unattainable object,

ii) Eye gaze at a staff member was a request for social interaction,

Subject B:

i) The extension of an object in hand paired with an eye gaze to the staff member as a signal for cooperative interaction from the staff member,

ii) Touching the staff member paired with eye gaze was a request for physical attention.

Subject C:

i) Eye gaze to a dropped object was a request for the object,

ii) The extension of one or both or arms to an unattainable object was a request for the object.

Subject D:

i) Eye gaze to a staff member paired with extension of one or both arms to an unattainable object.

ii) Eye gaze to a staff member paired with physical contact was a request for physical interaction from the staff member.

2. D.R.O.: Differential reinforcement of other behavior

The initial interval for each subject was set equal to the inverse of the mean response rate of behavior derived from the total number of sessions combined from group structured and group nonstructured sessions during the baseline condition. For example, the mean response rate of behavior for Subject A was calculated at a mean

rate per minute of 1.5. The inverse of the mean response was then calculated as follows:

1. 1 ÷ 1.5 (responses per minute) = 2/3
2. 2/3 x 60 seconds = 40 seconds

The mean rate of responding was determined individually for each student. The smallest interval was then selected as the DRO interval for the entire group. Subsequent intervals were increased or decreased approximately each four to six days. The method for increasing or decreasing an interval consisted of calculating the inverse of the mean response of the previous sessions for each subject, followed by the selection of the smallest interval of time.

The schedule of delivery of the reinforcement was defined as whole interval, such that the subject received the reinforcement at the end of the interval if he/she did not emit the target behavior during the entire interval (Repp, Barton & Brulle, 1983). A sound tape with a pre-recorded auditory signal cued the staff member when to deliver the reinforcer to the subject. Reinforcers were individualized for each student based on past observations and reports from the staff members.

Table II indicates the size of the DRO interval and the type of reinforcer delivered to each subject. Subject A, the first to receive the DRO treatment, began at an interval of 40 seconds on Day eleven. A subsequent interval on Day 14 was reduced to twenty-five seconds as the rate of behavior increased. On Day 20, the interval was increased to 40 seconds, based on the rate of behavior of both Subject A and C. Subject C remained on the interval of 40 seconds for a total of eight sessions. Subjects A and C received the subsequent DRO treatment on

TABLE II

DRO INTERVAL SIZES

Subject	Day	Size of Interval	Reinforcer
A	11	40 seconds	drink/edible
	14	25 seconds	drink/edible
	20	40 seconds	drink/edible
	DRO Reversal		
	41	30 seconds	drink/edible
B	39	30 seconds	edible
C	20	40 seconds	edible
	DRO Reversal		
	41	30 seconds	edible
D	42	30 seconds	drink/edible

Day 41, the interval size was based on the rate of behavior of all four subjects. The DRO phase was instituted on Day 39 for Subject B and Day 42 for Subject D. The initial interval for each was 30 seconds which remained constant for the remainder of the treatment phase.

3. Presentation of preferred sensory objects: Group structure

Preferred sensory objects were identified individually for each subject based on observations of their preferred mode of sensory input. The preferred sensory mode of input was defined as those types of stimuli, (visual, auditory, tactile, olfactory, gustatory) which would be likely to regulate, and engage the subject. Past observations during free play and sensory stimulation activities and reports from significant others were the measures utilized for selecting preferred sensory objects. Visual and tactile stimuli were selected for Subjects A and B. Examples included photo albums, books, rubber rings and stacking toys. Subject C demonstrated a preference for tactile stimulation and visual tracking of object movement. Prior to the study, Subject C was observed as frequently engaging with those toys which could be pushed, turned or pulled to elicit movement. Subject D demonstrated a strong preference for visual feedback of object movement, and selected those toys with strings attached, or frequently just strings or ribbons.

Upon completion of each instructional task each subject was presented with the preferred object. Objects were removed prior to the delivery of each task directive and replaced immediately following the delivery of the consequence for task performance (reinforcement or correction). Because the individual instruction was sequential in

presentation, each subject was given a maximum of two minutes between any one stimulus presentation to interact with the preferred object. If the subject rejected the object by throwing, or pushing it away, it was returned or replaced with an alternate preferred object.

During the group nonstructured activity the independent variable of presentation of prefered sensory objects did not apply. Rather, free access to preferred sensory stimuli in the group nonstructured activity was a constant variable and in effect in all experimental conditions.

Dependent Variable

The dependent variable was defined as the rate per minute of the self-stimulatory behaviors exhibited by each of the subjects. The self-stimulatory behaviors were defined in conjunction with the staff members based on frequent observations in the classroom. The target behaviors were operationally defined as follows:

Subjects A, B and D

Anytime the subject places any part of his hand or arm in the mouth. A minimum of 1-2 seconds must elapse after the hand/arm is removed from the mouth before scoring a second occurrence.

Subject C

Anytime the subject scratches or exhibits a repetitive circular hand motion, more than two consecutive times, on the table surface with one or both hands, an occurrence of one is scored. A minimum of two

seconds must elapse after the hand motion stops before scoring a second occurrence, thus a score of one equals one bout of behavior.

Measurement Procedures

The subjects were observed together, typically four days per week, in the context of a thirty minute session for each of the group structured and group nonstructured activities. Each thirty minute session was subdivided into two fifteen minute sessions, alternated daily between the specific time periods of 9:30-9:45, 10:15-10:30, 11:15-11:30, and 1:30-1:45. The purpose for subdividing into smaller segments of time within each thirty minute session was to integrate the study into the existing classroom schedule and provide realistic time periods of expected on task behavior for each subject.

Data was collected on the behavior of each subject by a frequency count during each full fifteen minute session. A data sheet was developed and distributed among staff members, which included (a) a definition of each target behavior, (b) the designated time and structure of the activity and (c) space available to record the frequency of behavior for each subject. During group structured sessions data was recorded on all three subjects simultaneously, by the staff member maintaining the group behavior. The one staff member involved with the group nonstructured session was responsible for simultaneous collection of data on all three students.

Prior to the study three training sessions were carried out in the experimental setting. Audiovisual taped recordings were made so the discrepancies in observations could be checked and behaviors

redefined, if necessary. Raw data were converted to rate per minute of behavior using the formula of dividing the number of occurrences by the number of minutes in the observation interval.

Interobserver Agreement

Reliability measures over a session were obtained on any three subjects simultaneously and the fourth subject individually. The video camera was unable to accurately focus on four subjects simultaneously, therefore it was necessary to film three subjects, followed by a separate film of the fourth subject. For the purposes of calculating interobserver agreement each fifteen minute session was subdivided into five minute sessions, resulting in three five minute intervals per fifteen minute session. The daily data sheet was organized such that the space alotted for fifteen sessions was further subdivided into three intervals and a timer was set for five minute intervals to cue the observers when to record in the appropriate space. (See Appendix A for illustration of data sheet.)

The formula to determine interobserver agreement was as follows:

$$\text{Percent Agreement} = \frac{\text{The sum of all smaller numbers of each interval from either observer A or B}}{\text{The sum of all larger numbers of each interval from either observer A or B}} \times 100$$

A major disadvantage of the frequency ratio method of interobserver agreement is the inability to determine whether observers agreed on any particular instance of behavior (Kazdin, 1982). As a result it is possible that the observers may never agree on the occurrence of any particular behavior, rather they may observe and record different instances of behavior, although their totals could be similar. Subdividing the fifteen minute sessions into smaller intervals of time was a method used to partially control for this limitation.

A minimum of one reliability check during each four day week occurred, including one fifteen minute session of both structured and non-structured group sessions. The minimum agreement accepted prior to implementing treatment was 80% agreement. A videotape machine was set up in the classroom to tape approximately half the sessions. The tapes were then viewed by trained staff not otherwise involved in the study, but who acted as second observers to determine the interobserver agreement. The observers involved in the study were not aware of which tapes would be used for the purpose of interobserver agreement. Following the viewing of the tapes the staff members involved in the study were given feedback in terms of total reliability for each of the sessions.

The overall interobserver agreement was 86% using the frequency ratio method. Table III displays the percentage of interrater reliability for each subject. The overall range of percent agreement was from 68% to 100%. As displayed in Table IV the total percent agreement for subject A during baseline condition was 83%; DRO condition 81%,

Preferred Sensory Objects 84%; and DRO 86%. Table V displays the percent agreement of subject A during the baseline condition as 86%; Preferred Sensory Objects 80%; and DRO condition as 86%. The percent agreement of Subject C's rate of stimulation behavior during baseline condition was 88%; DRO condition 86%; Preferred Sensory Objects 96%; and subsequent DRO condition 86% (Table VI). Fewer reliability checks occurred for Subject D as he entered the present study at a later date (day 18). The percent agreement of Subject D's rate of self-stimulatory during baseline condition was 87%; Preferred Sensory Objects 82%; and DRO condition 86%.

Experimental Design

This study employed a within subject design. A single -N- multiple -I- design (Kratochwill, 1978) was used to evaluate the effects of a (1) DRO procedure, and (2) the presentation of preferred sensory objects, on the rate of self-stimulatory behavior. The effects of the two treatments were evaluated independently within the type of activity, group structure and group nonstructure. The type of activity was alternated daily between four constant time periods during the baseline and treatment phases. An example of the alternating pattern is as follows:

TABLE III

DAY	SUBJECTS A	B	C	D	OVERALL % RELIABILITY
9	88%	90%	68%		82%
10	83%	76%	90%		83%
12	86%	96%	92%		91%
19	81%		80%	88%	90%
22	74%		92%	88%	86%
24	82%	92%	79%	86%	85%
28	74%	88%	98%		87%
29	80%	72%	87%		80%
32	88%	75%	100%		87%
33	86%	93%	93%	84%	89%
36	86%		100%	80%	90%
38	90%	73%	100%		88%
46	92%	82%	87%	84%	86%
	Overall Interobserver Agreement				86%

TABLE IV

Subject A:

DAY	CONDITION	TOTAL RELIABILITY
9 10	Baseline	83%
12 19 22 24	D.R.O.	81%
28 29 32 33 36 38	Preferred Sensory Objects	84%
46	D.R.O.	86%

TABLE V

Subject B:

DAY	CONDITION	TOTAL RELIABILITY
9 10 12 24 28 29	Baseline	86%
32 33 38	Preferred Sensory Objects	80%
46	D.R.O.	86%

TABLE VI

Subject C:

DAY	CONDITION	TOTAL RELIABILITY
9 10 12 19	Baseline	88%
22 24	D.R.O.	86%
28 29 32 33 36 38	Preferred Sensory Objects	96%
46	D.R.O.	86%

TABLE VII

Subject D:

DAY	CONDITION	TOTAL RELIABILITY
19 22 24	Baseline	87%
33 36	Preferred Sensory Objects	82%
46	D.R.O.	86%

Day	Time	Activity
1	9:30-9:45	Group Structure
	10:15-10:30	Group Nonstructure
	11:30-11:45	Group Structure
	1:30-1:45	Group Nonstructure
2	9:30-9:45	Group Nonstructure
	10:15-10:30	Group Structure
	11:30-11:45	Group Nonstructure
	1:30-1:45	Group Structure
3	9:30-9:45	Group Structure
	10:15-10:30	Group Nonstructure
	11:30-11:45	Group Structure
	1:30-1:45	Group Nonstructure

Rationale

The single -N- multiple -I design allows the researcher to successively introduce two or more interventions into one experimental unit. Kratochwill (1978) suggests that the single -N- multiple -1 design is of great value in experimental settings when the investigator finds that the B-phase fails to produce desired results. In such a case, data under the B condition can be used to formulate an alternate research question that can be incorporated into a revised new treatment, subsequently labelled the C phase. Introducing the treatment phases of B and C in both the group structured and group nonstructured activities produced two data paths and allowed for comparison of the rate of self-stimulatory behavior in each type of activity.

Experimental Conditions

Baseline (A)

During the baseline conditions in group structured and group nonstructured activities, the staff member did not respond to the occurrence of the targetted self-stimulatory behavior. However, during task presentation in the group structured activity, the behavior was interrupted if it interferred with task performance. The term interruption is used synonymous with correction procedure and involved the redelivery of the cue, minimal physical assistance to complete the task, followed by mild social praise. Interruptions of the behavior occurred only if the subject displayed the behavior between the time of the task directive and completion of the task.

DRO: Differential Reinforcement of Other Behavior (B)

DRO was applied as described in the section on Independent Variables, during group structure and group nonstructured activities.

Presentation of Preferred Sensory Objects (C)

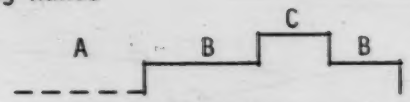
This intervention occurred during group structured activities between stimulus presentations. As defined previously in the section on Independent Variables, a group nonstructured activity involved constant free access to preferred sensory objects. Therefore upon introduction to preferred sensory objects during the group structured activity a return to baseline was in effect in the group nonstructured activity.

Figure I

Experimental Design Notations

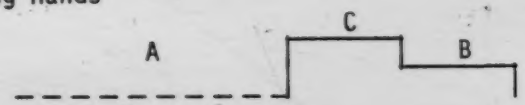
SUBJECT A

Mouthing Hands



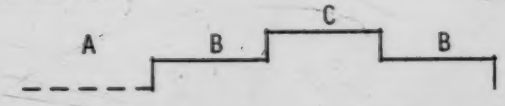
SUBJECT B

Mouthing Hands



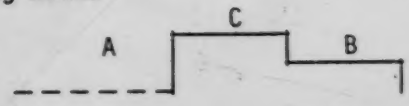
SUBJECT C

Hand Movements



SUBJECT D

Mouthing Hands



A = Baseline

B = DRO

C = Preferred Objects

DRO Reversal (B)

This intervention involved a return to the conditions of the initial D.R.O. phase. The D.R.O. reversal phase occurred only with subjects A and C.

Threat to Internal Validity

Kratochwill (1978) states a major threat to the internal validity of a single -N- multiple -I design as being the multiple intervention interference. Glass, Wilson and Gottman (1975) describe the multiple intervention interference as a change in the data series in the C phase, as potentially being directly due to the initial effect of the B phase or some combination of B and C. The following modifications in the design were employed to strengthen the internal validity:

i) A reversal to the DRO condition occurred for Subjects A and C in attempt to approximate the data series from the initial DRO condition.

ii) The sequence of the phases A.B.C. were altered for subjects B and D, resulting was the sequence of A.C.B.

CHAPTER IV

RESULTS

Results of Research Question One

The initial purpose of this study was to investigate the effects of the DRO procedure during two types of activity, group structured or group nonstructured. Table VIII displays the mean rate of self-stimulatory behavior for all subjects within baseline and treatment conditions. To briefly summarize the results, the application of the DRO procedure with subjects A, B and C in the group structured activity resulted in an increase in the rate of self-stimulatory behavior. To reconfirm the unexpected increase in self-stimulatory behavior resulting from the DRO procedure, this treatment was reintroduced for subjects A and C following condition C, (presentation of preferred objects). For subject A, the DRO procedure yielded an increase above baseline levels in the mean rate of self-stimulatory behavior. However Subject C demonstrated a slight decrease in the mean rate of self-stimulatory behavior from baseline condition to the subsequent DRO condition.

In the nonstructured group activity the DRO procedure was associated with a significant increase in the mean rate of self-stimulatory behavior of Subject B. The self-stimulatory behavior of Subject A was maintained at the same mean rate from baseline condition to the initial DRO condition, however, the behavior increased to above

TABLE VIII

The Mean Rate of Self-Stimulatory Behavior

Subject	Baseline		DRO		Preferred Objects		DRO (Reversal)	
	Non-Structure	Structure	Non-Structure	Structure	Non-Structure	Structure	Non-Structure	Structure
A	1.3	1.7	1.3	2.3	1.3	1.1	1.9	2.3
C	.7	1.5	.4	1.8	.4	.4	.5	1.2

Subject	Baseline		DRO		Preferred Objects		DRO (Reversal)	
	Non-Structure	Structure	Non-Structure	Structure	Non-Structure	Structure	Non-Structure	Structure
B	1.7	1.3	3.0	3.1	2.0	1.7		
D	1.2	1.1	.6	.6	.5	.9		

baseline rates within the subsequent DRO condition. A slight decrease in the mean rate of behavior of Subject C within the nonstructured group activity was apparent in both the initial and subsequent DRO conditions.

The DRO treatment was associated with a decrease in the mean rate of self-stimulatory behavior of Subject D in both the group structured and group nonstructured activities. The decrease in the mean rate of behavior may have been a result of the continuing downward trend established in the previous two conditions of baseline and preferred sensory objects.

The following discussion is an analysis of graphic data, for each subject as it pertains to research question one:

Subject A:

Figure II displays a highly variable baseline in the group structured and nonstructured activities which was maintained in the initial DRO and subsequent DRO conditions. The trend lines illustrated in Figure III in the group structured activity reveal an upward trend over the baseline period and change to a stable trend, with an increased level in the DRO treatment phase. The subsequent DRO condition replicates the results following baseline indicating an increased upward trend in the rate of self-stimulatory behavior. The data from the nonstructured activity show a downward trend in baseline condition moving to a slight increase in trend within the DRO condition. Reintroduction of the DRO condition a second time produces a similar upward trend, as demonstrated in the group structured activity. The

Figure II

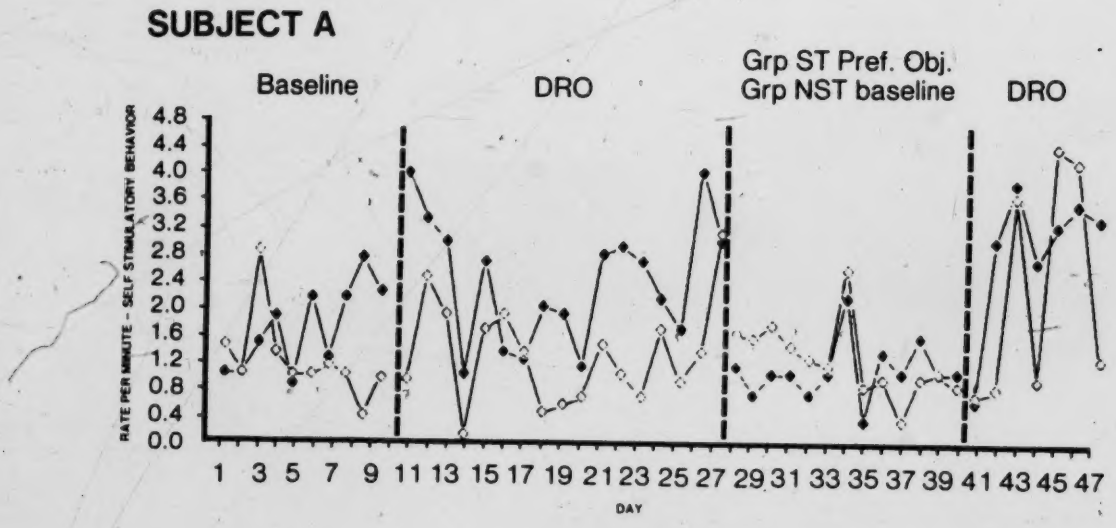
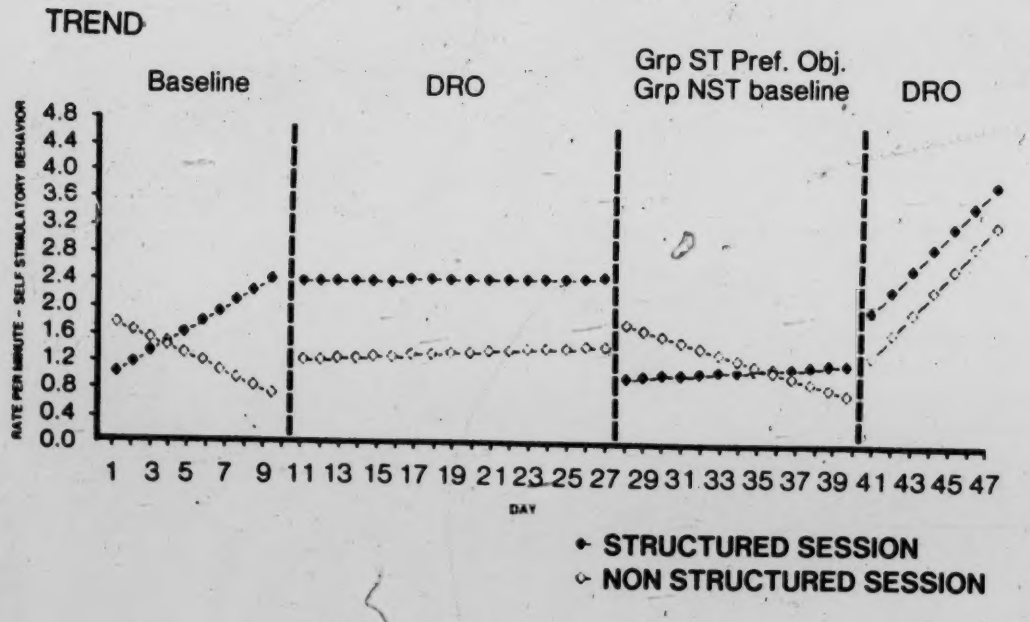


Figure III



changes in the level of trend lines from Baseline condition to DRO condition would indicate that the rate of self-stimulatory behavior was maintained at a lower level in the group nonstructured activity.

Subject C:

The design demonstrating the results for Subject C was a replication of the design utilized with Subject A. Figure IV illustrates a high degree of variability in the rate of self-stimulatory behavior in the baseline condition for both group structured and group nonstructured activities. The variability was decreased upon introduction of the DRO procedure in the group nonstructured activity, however the variability was maintained in the group structured activity.

As illustrated in Figure V the downward trend of behavior in the group structured activity was evident in both the baseline and DRO conditions. However, an abrupt increase of the level of the trend occurred upon introduction of the DRO condition for the structured activity. During the subsequent DRO condition an upward trend in behavior occurred, moving in a direction opposite to that of the trend lines in the Baseline and initial DRO condition. The DRO condition resulted in a downward trend in the data path during the nonstructured activity which further stabilized to a trend showing no change in the subsequent DRO condition. The rate of self-stimulatory behavior for Subject C was maintained at a lower rate in the group nonstructured activity during the DRO conditions.

The design of both subjects B and D was a systematic replication of the design utilized with Subjects A and C, however the C condition (presentation of preferred sensory objects) was introduced directly following the baseline condition. The DRO condition was then introduced as the final phase.

Figure IV

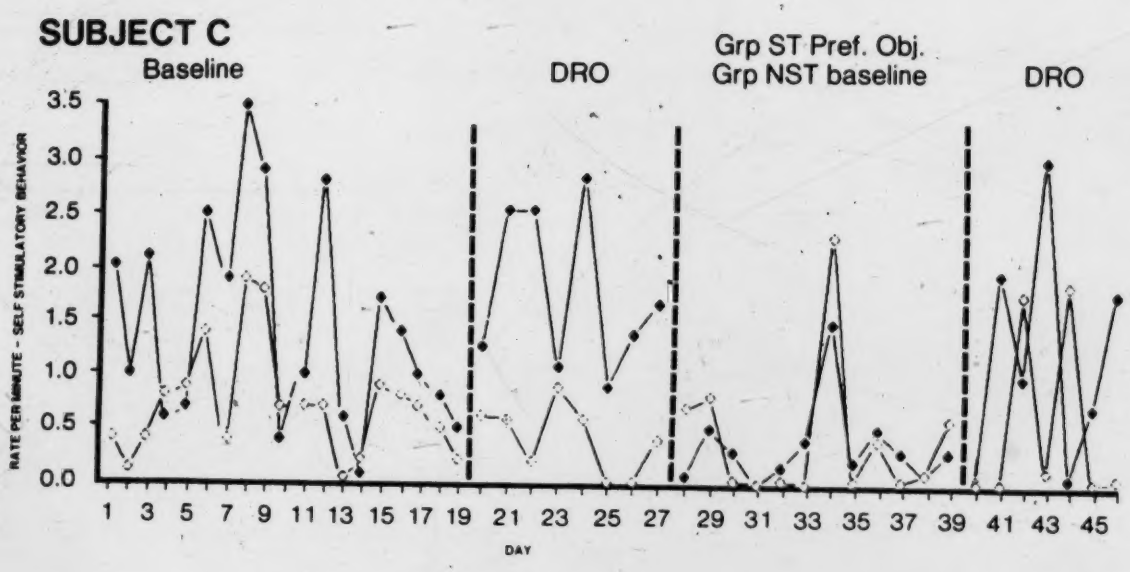
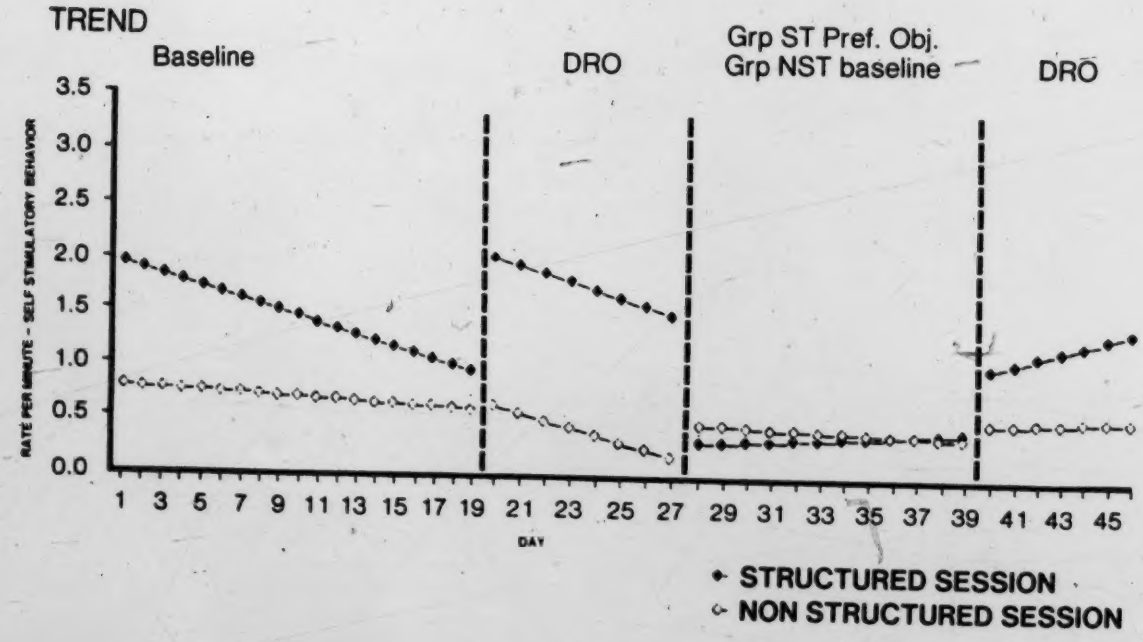


Figure V



Subject B:

The baseline condition for Subject B was interrupted on day fifteen for a period of seven observation days. The interruption was a result of absence due to illness. Given a significant period of time absent from the study, a second baseline period occurred on day twenty-three for a duration of eight additional observation days.

Figure VI demonstrates a highly variable data path during the group nonstructured activity during the baseline and DRO condition. The data path during the group structured activity indicates stability during the baseline condition, with increasing variability in the DRO condition. Separate trend lines were calculated for baseline period 1 (Days 1-15) and baseline period 2 (Days 23-30). The initial baseline period produced a slight decrease in the trend of behavior within the group structured activity with the opposite trend effect showing in the group nonstructured activity. The downward trend continued at the exact level during baseline condition II in the group structured activity however an increased upward trend was apparent in the group nonstructured activity. The introduction of the DRO condition indicates an abrupt increase in level with an upward trend in the structured activity. The upward trend in the nonstructured group activity observed in baseline II, continued during the DRO condition. Similar to Subjects A and C, the rate of self-stimulatory behavior for Subject B was maintained at a slightly lower rate during the DRO condition in the group non-structured activity.

Figure VI

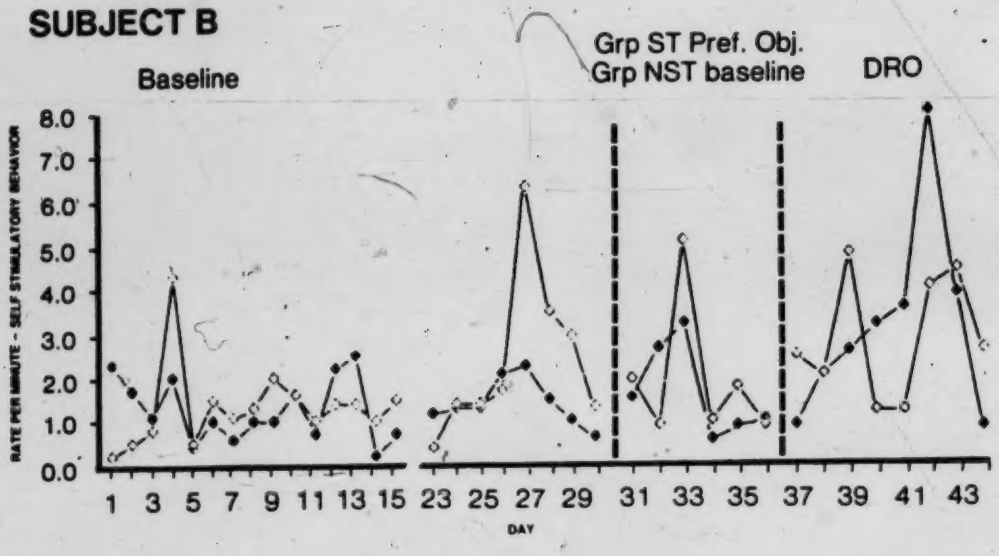
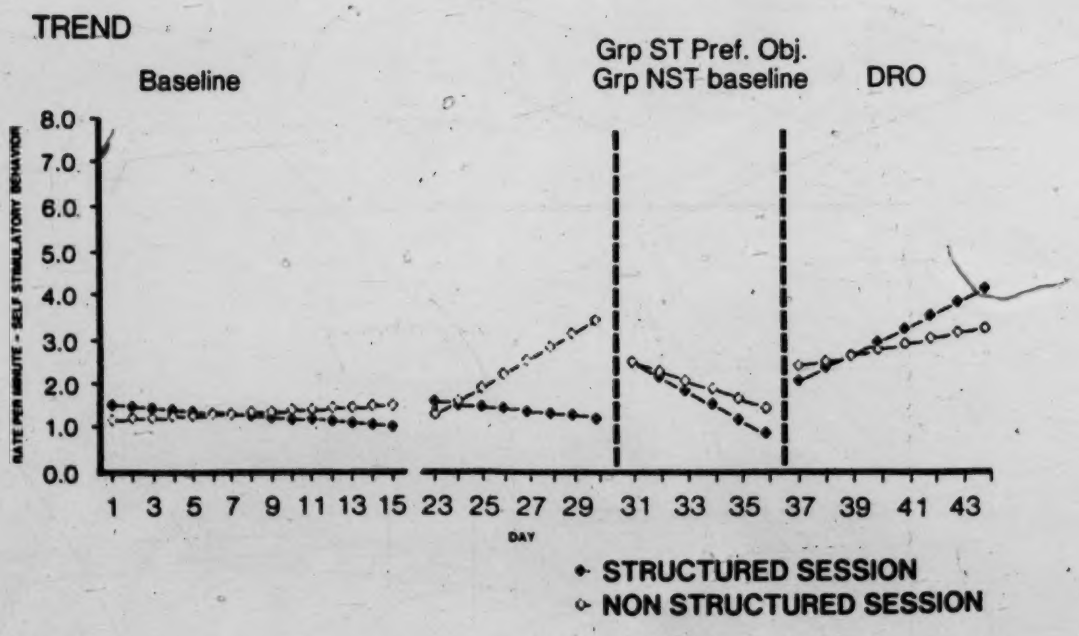


Figure VII



Subject D:

Subject D, a student who was recently transferred from a school out of the Edmonton Public School District, joined the study on day eighteen during the absence of Subject B. The rationale for including Subject D in the study which was already in progress was as follows:

1) Subject D engaged in a minimum of one self-stimulatory behavior which interfered with learning on instructional tasks.

2) Involving Subject D in the study maintained the group size of the minimum of three subjects in both the group structured and group nonstructured activities.

In addition to the self-stimulatory behavior, Subject D displayed a large repetoire of maladaptive behaviors which required that he receive a continuous ratio of 1:1 supervision.

Consequently the following changes occurred in the experimental conditions, specific to Subject D only:

An additional instructional aid was seated directly behind Subject D in both structured and nonstructured activities. Interaction occurred from the instructional aid only if Subject D attempted to leave the group activity, or if he displayed the communicative behaviors outlined in the Methods chapter (see Independent Variables, Group nonstructured activity). The instructional aid assigned to Subject D, did not interact with any of the other three subjects at any time during the study.

Figure VIII displays a highly variable baseline in both the group structured and group nonstructured activities. The degree of variability was maintained in the nonstructured activity during the

Figure VIII

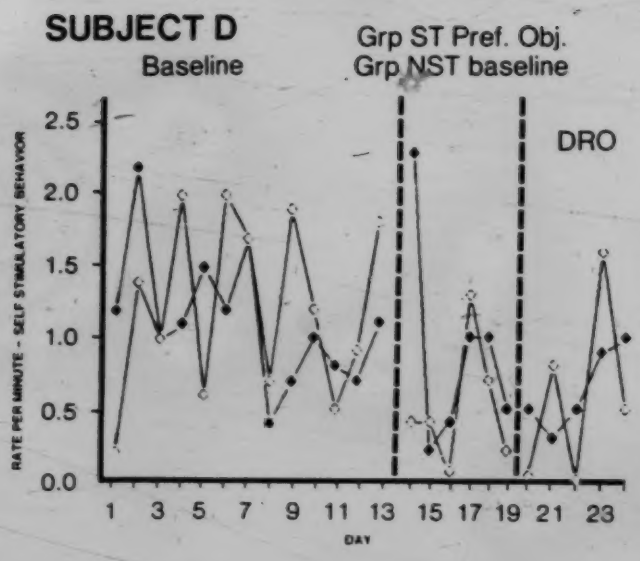
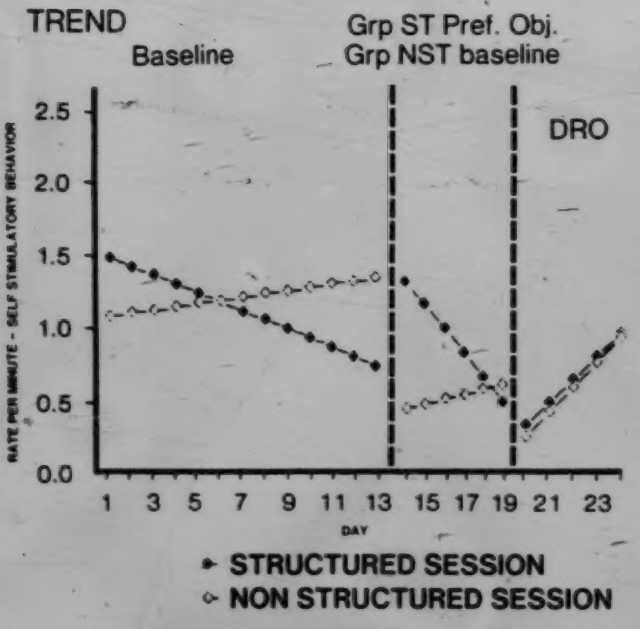


Figure IX



DRO condition, however it lessened in the structured activity. The downward trend in the group structured activity showed a decrease in level from Baseline to DRO condition. However, the downward trend in baseline condition changed to an upward trend immediately upon introducing the DRO condition. The data path of the group nonstructured activity also demonstrated an abrupt decrease in level from baseline to the DRO condition, however, a continued upward trend was apparent during the DRO condition. Unlike Subjects A, B, and C, the self-stimulatory behavior of Subject D occurred at the same rate in the group structured and group nonstructured activities during the DRO condition.

Summary of Results: Research Question One

In response to research question one, in which type of activity, group structured or group nonstructured, would a DRO procedure result in the greatest reduction of self-stimulatory behavior, the data provide inconclusive evidence. Subjects A and C demonstrated a lower rate of self-stimulatory behavior in the group nonstructured activity during the initial DRO condition, however the reverse effect was apparent in the subsequent DRO condition. In view of the variability within the data of Subject B in both the group structured and group nonstructured activities, it would be difficult to draw conclusions. The self-stimulatory behavior of Subject D occurred at the same rate in the group structured activity as in the group nonstructured activity.

The present experiment failed to demonstrate a significant difference in the rate of self-stimulatory behavior within a group

structured or group nonstructured activity when a DRO procedure was in effect. In addition, the data would support that an increase in the rate of self-stimulatory behavior was associated with the DRO treatment with Subjects A, B and C in the group structured activity, and Subjects A and B in the group nonstructured activity. Although the mean rate of behavior of Subject D decreased in both the group structured and group nonstructured activities the upward trend in the data path would suggest the DRO treatment to have a minimal effect on the rate of behavior.

Results: Research Question Two

Given an increase in self-stimulatory behavior under the DRO condition, group structured activity, with Subjects A, B, and C, the second research question was formulated; will the presentation of preferred sensory objects (condition C) between stimulus presentations within the group structured sessions be more effective than a DRO procedure in reducing the rate of self-stimulatory behavior?

The presentation of preferred sensory objects within the group structured activity was associated with a decrease in the mean rate of behavior to below baseline rates with Subjects A, C and D (See table VIII). Subject B demonstrated a slight increase in the mean rate of self-stimulatory behavior from baseline to the condition of preferred sensory objects. The mean rate of behavior of Subjects A and C was significantly decreased when moving from the DRO treatment to the condition of preferred sensory objects. Replicating the results, the subsequent DRO treatment was associated with abrupt increases in the mean

rate of behavior for both Subjects A and C. Subject B experienced a significant increase in the mean rate of behavior upon moving from the condition of preferred sensory objects to the DRO treatment, however Subject D demonstrated a minimal decrease in the rate of behavior from preferred sensory objects in the DRO treatment. The nonstructured activity with all subjects was a continuation of the baseline condition as preferred sensory objects were constantly available to each subject during the experiment.

The following discussion is a graphic analysis of the data for each subject as it pertains to the results of research question two: for group structured actvities.

Subject A:

The variability in data during the DRO condition stabilized upon introduction of the condition of preferred sensory objects (see figures II and III). A trend in the data was not apparent in either the DRO condition or preferred sensory objects. However, an abrupt decrease in level was associated with the condition of preferred sensory objects. Introduction of the subsequent DRO condition demonstrated an upward trend in the data with an increase in level of the trend.

Subject C:

A high rate of variability in data was apparent in both conditions of baseline and DRO, however the variability was reduced during the condition of preferred sensory objects (see figures IV and V). The

downward trend of data during the baseline and DRO treatment phase changed to no trend with a significant decrease in level during the condition of preferred sensory objects. Introduction of the subsequent DRO phase was associated with an upward trend in the data path and an increased level.

Subject B:

The variability in data increased from baseline condition during the condition of DRO (see figures VI and VII). A trend in data was not apparent during baseline condition. The downward trend during the condition of preferred sensory objects increased in level from the baseline condition. Upon introduction of the DRO condition an upward trend with be an increase in level was apparent.

Subject D:

Highly variable data occurred in all conditions with Subject D (see figures VIII and IX). The downward trend of data in baseline and the condition of preferred sensory objects changed to an upward trend in the DRO condition. An increase in level of trend occurred from the baseline to the condition of preferred sensory objects. A slight decrease in level of trend was apparent from the preferred sensory objects to the DRO condition.

Group Nonstructured Activity

The procedure of preferred sensory objects did not occur during the group nonstructured activity as the nature of the activity was

such that preferred objects were freely accessible. Therefore during the group nonstructured activity a return to baseline was in effect. The rate of self-stimulatory behaviors for Subjects A and C were consistent with the initial baseline condition. The mean rate of behavior for Subject A in the initial baseline period was 1.3, and remained at 1.3 in the subsequent baseline period. For Subject C a slight decrease in the mean rate from .7 responses per minute in the initial baseline period to .4, in the subsequent baseline period occurred. Subject B demonstrated a slight increase in mean rate of behavior, ($\bar{X}$ = 1.7 in initial baseline; $\bar{X}$ = 2.0 in subsequent baseline), while Subject D displayed a decrease in the mean rate of behavior from initial baseline of 1 to subsequent baseline of 0.5.

The trend lines of Subjects A and C moved downward in the subsequent baseline condition, consistent with the trends of the initial baseline period. Minimal changes in level were apparent in the trends for either Subjects A or C. The data trend of Subject B during baseline was upward, however changed to a downward trend when continuation of baseline in the C condition occurred. Highly variable baseline data would suggest no effect with the pretreatment conditions. The data path of Subject D produced a slope in the upward trend comparable to the initial baseline period, however an abrupt decrease in level occurred.

Summary of the results: Research question 2

Lower rates of self-stimulatory behavior were found under the preferred sensory object condition than under the DRO condition for Subjects A, B and C. Subject D demonstrated only a slight increase in the rate of behavior from preferred sensory object condition to the DRO condition, however an upward trend was apparent in the DRO condition. The data supports that the presentation of preferred objects between stimulus presentations in a group structured activity is effective in suppressing the rate of self-stimulatory behavior. In addition, preferred sensory objects were more effective than a DRO procedure in reducing the rate of self-stimulatory behavior with three of the four subjects.

CHAPTER V

DISCUSSION

The Effects of a DRO Procedure on Self-stimulatory Behavior

The DRO procedure in which reinforcement is delivered contingent upon a predetermined period of nonoccurrence of the self-stimulatory behavior is not always effective in applied settings (Fox & Azrin, 1973; Harris & Wolchik, 1979; Tierney, McGuire & Walton, 1979). Harris and Wolchik (1979), and Fox and Azrin (1973) both demonstrated an overcorrection procedure to be more effective than a DRO procedure. Neither author postulates as to why the DRO procedure was ineffective in decreasing the rate of self-stimulatory behavior. Tierney et al. (1979) suggest the ineffectiveness of the DRO procedure was a result of the difficulty the staff experienced in implementing the procedure. Therefore it was probable that reinforcers may have been delivered inappropriately. The authors report that a DRO schedule requires great vigilance by highly motivated staff.

The present study indicated the DRO procedure to increase the rate of self-stimulatory behavior with Subjects A, B and C to above baseline levels in the structured activity and Subject B in the nonstructured activity. The initial DRO procedure had no apparent effect on Subject A's rate of behavior in the nonstructured activity, however the subsequent DRO procedure produced an increase in the self-stimulatory behavior to above the baseline mean. The initial and subsequent DRO procedure produced a minimal impact on the rate of behavior for Subject C in the nonstructured activity.

By definition, the rate of behavior is the average frequency of behavior emitted during a standard unit of time. The average fails to reflect the total number of occurrences. Therefore increases in the rate of behavior under the DRO condition demonstrate applied significance, as the actual numbers of occurrences are not displayed in these mean rates and would be 30 times the one-minute rate for a half-hour session.

The present study utilized the appropriate interval size for each subject, calculated according to the formula prescribed and successfully utilized by Repp & Deitz (1974). Repp & Slack (1977) identify the appropriate interval size as a variable that determines the success of the DRO procedure. Therefore, if the initial DRO interval were inappropriately calculated, it could account for the failure of DRO to reduce undesired responding in previous research. As Tierney et al. (1979) suggested the ineffectiveness of the DRC procedure may be associated with the difficulty in delivering the reinforcer for high rates of self-stimulatory behavior with a group of subjects. This problem has implications for the applied value of the procedure. Successful studies in the past typically used personnel in addition to the employed staff, as observers recording data.

Research Question One

This writer postulated that the reinforcement procedures contingent upon task performance in the group structured activity could possibly influence the effectiveness of the DRO procedure. Thus the initial purpose of the study was to determine in which type of

activity, group structured or group nonstructured would a DRO procedure result in the greatest reduction of self-stimulatory behavior.

Results of the present study indicate that Subject A and C displayed a lower rate of self-stimulatory behavior in the group nonstructured activity upon introduction of the DRO condition. Given highly variable data from Subject B it was difficult to determine in which activity a lower rate of behavior occurred. Subject D demonstrated no difference in the rate of behavior from group structured to group nonstructured when a DRO procedure was in effect. With the exception of the DRO procedure, the delivery of reinforcement to any one subject in the nonstructured activity was not always contingent, consistent, nor systematic. The staff to student ratio was lower, (1:3), than the group structured activity (2:3), so that although contingencies for interaction and reinforcement were defined they did not always occur if the one staff member was not attending to the specific subject at the time. Subsequently the reinforcement contingent upon task performance and a high rate of systematic attention may not affect the efficacy of the DRO procedure. The data would support inconclusive findings in this experiment with regards to greater efficacy of the DRO procedure given one type of activity (group structured, group nonstructured). An advantage to any one type of activity was not apparent.

Research Question Two: Presentation of Preferred Sensory Objects

Given an increase in the rate of self-stimulatory behavior with three of the four subjects, in the DRO condition, group structured

activity, a second research question was examined. The present research explored the effects of the presentation of preferred sensory objects introduced between stimulus presentations in the group structured activity. The results of the present study indicate that by introducing preferred sensory stimuli between stimulus presentations a reduction in the rate of self-stimulatory behavior below rates established in the DRO condition occurred with Subjects A, B and C.

The effects of novel stimuli on rates of self-stimulatory behaviors have been the subject of past investigations. Romanczyk, Kristner & Plienis (1982) cite the arousal induction hypothesis which assumes that as an organism is provided with additional stimulation, rates of self-stimulatory behaviors will decrease. Some studies (Berkson & Mason, 1964; Moseley Faust & Reardon, 1970) have empirically supported this hypothesis.

Romanczyk, et al. (1982) cite Lovass (1967) stating that the performance of self-stimulation may be intrinsically reinforcing and that reinforcers which normally maintain adaptive behaviors such as praise, physical contact and approval are weak compared to the reinforcement inherent in self-stimulation. Perhaps the increased rate of self-stimulatory behaviors with three of the four subjects with the DRO procedure are a function of the reward value of the reinforcers. If one considers self-stimulation to be potently reinforcing for the child, then increasing the probability that the child will perform an alternative behavior may be strongly related to the reinforcers offered. Therefore, Romanczyk et al. (1982) suggest that DRO procedures could be made more effective through the use of sensory

reinforcers. As a result the reward values would compete with the self-stimulatory behavior. However if the rewards are sensory reinforcers, incompatible to the self-stimulatory behavior one might define this approach as a DRI (differential reinforcement of incompatible behavior). DRI is a procedure which the contingent application of a reinforcer strengthens a response which is incompatible with another, undesired response. The contingent use of sensory reinforcers could be in fact incompatible with the self-stimulatory behavior. In such a case the DRO procedure no longer exists, rather the shaping up (reinforcing) of an incompatible, appropriate stimulatory behavior occurs. One no longer is concerned with the absence of the maladaptive response, rather the focus is on the incompatible, appropriate behavior.

Murphy, Nunes and Hutchings-Ruprecht (1977) studied the effects of continual access to a reinforcing stimulus on the self-stimulatory behavior displayed by two individuals with profound handicapping conditions. In experiment one the reinforcing stimulus was removed for a period of time if the subject engaged in the self-stimulatory behavior. In experiment two the subject was given continuous access to the vibratory stimulation for the non-occurrence of the mouthing behavior. The subject had to wait a period of fifteen seconds after the termination of the targetted behavior in order to regain access to vibration. The results of the two experiments displayed in a (1) reversal design, and (2) multiple baseline across settings indicated substantial decreases in the rate of self-stimulatory behavior to near zero levels.

The authors speculated that when the undesired behavior occurs frequently, methods which directly suppress behavior, rather than methods which increase behavior must be employed initially. As a suppression method, the authors suggest, as introduced in experiments one and two, contingent access to sensory reinforcers upon the nonoccurrence of the target behavior. However, the authors propose a new research question stating a need to determine to what extent the noncontingent presence of sensory reinforcers would produce suppression.

The present research provides new information with respect to this question. The data support that noncontingent availability of preferred sensory objects reduces the rate of self-stimulatory behavior in group structured activity. Noncontingent access to preferred sensory objects provides increased opportunities for the student to engage in appropriate incompatible behaviors.

Increasing Appropriate Behavior

Severely handicapped children who have not acquired complex repetoires of adaptive behaviors, often display other forms of behavior which we judge as negative (Evans & Meyer, 1985). Examples would include self-stimulatory, disruptive, aggressive and self-injurious behavior. Earlier methods of behavior modification emphasized suppression strategies, including punishment procedures such as overcorrection, timeout and restraint. As the science of modifying behavior became more concerned with the dignity of the child, and the ethical considerations of punishment procedures were examined, researchers

focussed on developing those strategies which were least restrictive in nature. Included was the DRO procedure which many researchers encourage as a viable alternative to punishment procedures for the supression of maladaptive responding. Although less restrictive in nature as it does not produce restraint or pain to the student, it's emphasis still focusses on the suppression of undesired behavior.

Evans and Meyers (1985) suggest instructional based strategies to increase appropriate behaviors, rather than suppression of the inappropriate behavior. The systematic training of new appropriate behaviors to replace undesired responding increases the child's repetoire of adaptive behaviors. Over time these behaviors can be maintained and generalized to new environments. Suppressing inappropriate responding through the use of differential reinforcement of other behavior does not ensure the behavior will be maintained at a low rate, nor does it provide the child with an alternative adaptive response. Lichstein and Kachmarik (1980) studied the effects of a DRO procedure on the thumbsucking of two school aged children of normal intelligence. The results indicated that the DRO procedure did in fact rapidly decrease the frequency of thumbsucking. However, maintenance of the reduced behavior across time was not evident. Rather, after three months the behavior returned to baseline levels for both subjects. Teaching new behaviors, increasing adaptive responding would appear to be a desirable, and ecologically valid approach to the management of undesirable behaviors.

Individual Responses

The results for Subject D indicated that a DRO procedure was more effective than the presentation of preferred sensory objects in reducing the rate of self-stimulatory behavior in the group structured activity. Contrary to the results of Subjects A, B and C, the reduced rate of self-stimulatory behavior from baseline condition was at the same rate in the nonstructured activity as in the structured activity.

As noted earlier, although the mean rate of behavior of Subject D was lower in the DRO condition than the preferred sensory objects condition, an abrupt upward trend was apparent within the DRO condition. As the experimental conditions for Subject D were such that 1:1 supervision was available at all times, it may account for the initial success of the DRO procedure. Given the consistent individual attention, the reinforcement delivery would have occurred promptly and consistently paired with maximum social reinforcement. This seemed comparable to effective use of a DRO procedure in past investigations where an individual subject receives the treatment under the supervision of one observer. This may have implications for the applied value of the DRO procedure in the classroom setting, specific to the need of a higher staff to student ratio.

In addition the factor of individual responsiveness should be considered. What serves to decrease the inappropriate responding of one individual may not be as effective for a second individual. Perhaps when attempting to decrease the undesired behavior, or to teach the new behaviors, strategies should focus on the individual needs and responses of the student, rather than on the needs or responses of the

group as a whole. This requires careful data-based monitoring of each program to confirm its suitability to the individual student.

Social Validation: Subjective evaluation

Subjective evaluation was used as a measure to solicit the opinions of the observers which participated in the study. The purpose of the evaluation was to gain feedback on the applied value of the interventions DRO and presentation of preferred sensory objects in the natural classroom setting. Anecdotal reports were documented by this writer during the course of this research. The following are a list of reported advantages and disadvantages as they pertain to each intervention.

DRO: differential reinforcement of other behavior

Advantages

1. The application of the DRO procedure resulted in increased competencies in behavioral observation and frequency recording. The use of a DRO procedure with a group of subjects required consistent recognition of multiple behaviors, contingent delivery of primary reinforcement and recording of the multiple occurrence of behaviors.

Disadvantages

1. A higher staff to student ratio would be necessary across all situations to efficiently and reliably implement the DRO procedure.

2. The preparation prior to each DRO session required additional time to retrieve the necessary materials (e.g. tape recorder, tape, primary reinforcements).

3. Each time a change in the DRO interval occurred, additional preparation time was needed to determine the interval size and pre-record a sound tape.

4. It would be awkward and inconvenient to implement the DRO procedure in the community environment. In addition, the procedure would be viewed as unnatural and inconsistent with the normalization principle.

5. The DRO procedure did not result in increasing appropriate behaviors therefore instructional procedures to train adaptive responses were required in addition to the DRO procedure.

Presentation of preferred sensory objects:

Disadvantages were not reported.

Advantages

1. Presentation of preferred sensory objects could be integrated and generalized in a variety of school and community environments.

2. Preferred sensory objects regulated (calmed) and engaged the subject. Regulation and engagement are necessary for learning to occur.

3. The presentation of preferred sensory objects was an educational intervention which focused on the acquisition of skills and provided information for future educational programming.

4. The presentation of preferred sensory objects was a fun activity for both the observers and subjects.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

Summary

The purpose of the study was 1) to determine in which type of activity, group structured or group nonstructured would a DRO procedure be most effective in reducing the rate of self-stimulatory behavior, and 2) to determine if the presentation of preferred sensory objects within the group structured sessions would be more effective in reducing the rate of self-stimulatory behavior. The group structured activity, a sequential model was one in which each student was taught individually in a sequential fashion while other students were present and waiting in the group. A staffing ratio of two staff members to three students existed in the group structured activity. A group nonstructured activity was one which involved a ratio of one staff member to three subjects where the subjects were given a period of free time to interact with preferred toys.

The dependent variable, the rate of self-stimulatory behavior was measured using a frequency count during the context of four, daily fifteen minute sessions approximately four days per week. The independent variables were defined as: 1) the type of activity, group structured and group nonstructured; 2) a DRO procedure, and; 3) the presentation of preferred sensory objects between stimulus presentations in a group structured activity. A single-N-multiple-I design was used to evaluate the effects of 1) a DRO procedure, and 2) the presentation of

preferred sensory objects on the rate of self-stimulatory behavior. The effects of a DRO procedure were measured in each type of activity, while the effect of preferred sensory objects was measured only during a group structured activity. In order to strengthen the internal validity of the design, threatened by the multiple intervention interference effect, a reversal to the DRO condition occurred for Subjects A and C within the design sequence of Baseline, DRO, Preferred Sensory Objects, DRO. In addition, the sequence of conditions was reversed for Subjects B and D, resulting was the sequence of Baseline, Preferred Sensory Objects and DRO.

The investigation on the effect of which type of activity would a DRO procedure be most effective in reducing the rate of self-stimulatory behavior gives support for the following conclusions:

1. A significant difference in the rate of self-stimulatory behavior was not evident within a group structured or group nonstructured activity when a DRO procedure was in effect. Therefore the data support inconclusive findings in this experiment with respect to research question one.

2. An increase in the rate of self-stimulatory behavior was associated with the DRO procedure, with three of the four subjects in the group structured and group nonstructured activities. Although the mean rate of self-stimulatory behavior of the fourth subject decreased in both types of activity an upward trend in data during the DRO condition would suggest a DRO procedure to have a minimal and temporary effect on the reducing the rate of behavior.

The investigation to determine if the presentation of preferred sensory objects in the group structured activity would be more effective than a DRO procedure in reducing the rate of self-stimulatory behavior gives support for the following conclusions:

1. Lower rates of self-stimulatory behavior were found under the preferred sensory object condition than under the DRO condition with Subjects A, B and C.

2. Subject D demonstrated only a slight increase in the rate of behavior from the preferred sensory object condition to the DRO condition, however an upward trend in data was apparent in the DRO condition.

3. The presentation of preferred sensory objects within the group structured activity was associated with a decrease in the mean rate of behavior to below baseline rates with Subjects A, C and D.

Recommendations for Future Research

The following recommendations are suggested for further research in the area of reducing self-stimulatory behavior:

1. Although results demonstrate the condition of preferred sensory objects between stimulus presentations to be effective in reducing the rate of self-stimulatory behavior with three of the four subjects, measurement of appropriate interaction with objects did not occur. Therefore this study does not rule out the possibility that the subjects could have interacted with the objects in an inappropriate manner (eg. mouthing toys). A consideration for further research is whether the rate of appropriate interaction with objects occurs as the rate of

self-stimulatory behavior decreases during the condition of preferred sensory objects.

2. With the DRO procedure, the student is reinforced if not engaging in the undesired behavior. Thus reinforcement occurs if the student is engaging in any other behavior other than the target excess behavior. Perhaps further research on the effectiveness of a DRO procedure where reinforcement is delivered for the absence of the target and the absence of any other defined excess behavior should occur. This may prove to rule out the reinforcement of an alternate excess behavior, as a limitation to the procedure.

3. It may be useful to gather feedback from observers in the classroom environment so as to evaluate the application of a DRO procedure in a classroom setting. The evaluation would focus on questions which pertain to the ecological validity of the procedure within an applied setting.

Implications for Behavioral Programming

Evans and Meyer (1985) suggest that a DRO procedure should be viewed as a strategy to assist teacher decisions regarding the most appropriate time to reinforce the student. A pre-recorded auditory signal at a prespecified interval could assist the teacher to catch the students being good. The DRO as a behavioral technique in itself focusses on the suppression of behavior, rather than increasing appropriate behavior. Perhaps our emphasis should be placed on the development of new skills, as a means to replace excess behavior. Thus traditional behavior modification methods are replaced with positive educational programming methods.

Many factors influence the occurrence of undesired responding. Reinforcement procedures are merely one strategy amongst many to be considered when reducing behavior. Evans & Meyer (1985) introduce curricular strategies to teach a positive alternative. They consist of 1) providing the learner with a communicative signal to reject or accept an activity; 2) allowing the learner to adjust arousal levels, block out distracting stimuli and selectively attend to particular activities, and 3) increase play skills to decrease excess stereotyped movements. This writer wishes to add strategies based on the present research consisting of:

1) Providing students with increased time to interact with objects, thus decreasing potential "down" time.

2) Providing students with objects which are individualized to the student sensory preferences. For example the student who has a high preference for auditory input should be provided with objects providing constant auditory feedback.

In summary, teaching new behaviors and increasing opportunities to engage in appropriate behavior would appear to be a functional and ecologically valid approach to reducing excess behavior.

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APPENDIX A

Day:

Date:

	9:30 - 9:45			10:00 - 10:15			11:15 - 11:30			1:30 - 1:45		
	Condition Group Structure			Condition Group NonStructure			Condition Group Structure			Condition Group Nonstructure		
	5 min	5 min	5 min	5 min	5 min	5 min	5 min	5 min	5 min	5 min	5 min	5 min
Subject [illegible] Mouthing Hands												
Subject D Mouthing Hands												
Subject C Hand Movements												
Subject D Mouthing Hands												

APPENDIX B

Date		A		B		C		D	
		Struc.	N.St.	Struc	N.St.	Struc.	N.St.	Struc.	N.St.
Day									
1	March 4	1.1	1.53	2.3	.2	2.0	.4		
2	5	1.1	1.1	1.7	.5	1.0	.1		
3	7	1.53	2.9	1.1	.8	2.1	.4		
4	11	1.93	1.4	2.0	4.3	.6	.8		
5	12	.93	1.06	.4	.5	.7	.9		
6	14	2.23	1.06	1.0	1.5	2.5	1.4		
7	15	1.3	1.2	.6	1.1	1.9	.4		
8	18	2.2	1.06	1.0	1.3	3.9	1.9		
9	21	2.8	.43	1.0	2.0	2.9	1.8		
10	22	2.3	1.0	1.6	1.6	.4	.7		
	April	DRO							
11	1	3.7	.93	.7	1.0	1.0	.7		
12	2	3.1	2.3	2.2	1.4	2.8	.7		
13	4	2.8	1.8	2.5	1.4	.6	.03		
		DRO							
14	9	1.7	.2	.2	1.0	.06	.2		
15	11	2.5	1.6	.7	1.5	1.7	.9		
16	15	1.3	1.8	Absent		1.4	.8		
17	16	1.2	1.3	Absent		1.0	.7		
18	18	1.9	.53			.8	.5	1.2	.2
19	19	1.8	.63			.5	.2	2.2	1.4
		DRO				DRO			
20	22	1.1	.7			1.3	.63	1.0	1.0
21	23	2.6	1.4			2.6	.6	1.1	2.0
22	25	2.7	1.0			2.6	.2	1.5	.6
23	29	2.5	1.7	1.2	.4	1.1	.9	1.2	2.0
24	30	2.0	1.6	1.3	1.4	2.9	.6	1.7	1.7
25	May 2	1.6	.9	1.3	1.4	.9	0	.4	.73
26	3	3.7	1.3	2.1	1.7	1.4	0	.7	1.9
27	6	2.8	2.9	2.3	6.5	1.7	.4	1.0	1.2

Date		A		B		C		D	
		Struc.	N.St.	Struc	N.St.	Struc.	N.St.	Struc.	N.St.
Day									
		Preferred Objects				Preferred Objects			
28	May 7	1.2	1.7	1.5	3.6	.06	.7	.8	.5
29	9	.8	1.6	1.0	3.0	.5	.8	.7	.9
30	10	1.1	1.8	.6	1.3	.3	.03	1.1	1.8
				Preferred Objects					
31	13	1.1	1.5	1.6	2.0	0	0	Absent	
32	14	.8	1.3	2.7	.93	.16	.03	Absent	
								Preferred Objects	
33	16	1.1	1.2	3.3	5.2	.4	0	2.3	.4
34	17	2.2	2.6	.6	1.0	1.5	2.3	Absent	
35	21	.4	.9	.9	1.8	Absent		.2	.4
36	24	1.4	1.0	Absent		.2	.03	.4	.06
37	27	1.1	.4	Absent		.5	.4	1.0	1.3
38	28	1.6	1.0	1.0	.9	.3	.03	1.0	.7
				DRO					
39	30	1.1	1.1	.9	2.5	.1	.1	.5	.2
40	31	1.1	.9	2.1	2.06	.3	.6	Absent	
		DRO				DRO			
41	June 4	.7	.8	Absent		.03	0	Absent	
								DRO	
42	6	3.0	.9	2.6	4.9	2.0	0	.5	.03
43	7	3.8	3.6	3.2	1.2	1.0	1.8	.3	.8
44	10	2.7	1.0	3.6	1.2	3.1	.1	.5	0
45	11	3.2	4.3	8.2	4.1	.03	1.9	.9	1.6
46	13	3.5	1.4	3.9	4.5	.7	0	1.0	.5
47	14	3.3	1.3	.8	2.6	1.8	.03	Absent	